

## **Seat made of molded plywood glued together in layers**

### Field of application of the invention

The present invention relates to a seat, preferably a chair, made of molded plywood which is glued together in layers. The special features here involve the arrangement, fastening and shape of the legs and of any armrests. The invention furthermore relates to a row connector for placing the seats in an orderly row.

### Prior art

10 Seats made of molded plywood which is glued together have been known for a long time. The legs and armrests are screwed or riveted to the seat and/or the backrest, which requires the provision of through holes and of the respective connecting elements. The connecting elements which are partially visible may have an annoying effect esthetically and also cause a certain outlay on material and installation. When the chairs are piled up in a stack, the stack height is increased by the connecting elements, i.e. a low stack density is obtained. In addition, the connecting elements on the upper side of the seat plate of the chair arranged below in each case may cause damage if protective precautions are not taken. Such connecting elements of the chairs positioned above in each case leave behind lasting or only partially and gradually re-forming deformations in seat cushions.

Furthermore, seats made of plastic are known, in which the upper ends of the feet and also the armrest attachments are cast into the plastic. However, the visual, esthetic and sensitive advantages of natural wood have to be left out in this case.

### Object of the invention

In view of the hitherto still imperfect arrangement, fastening and shape of feet and armrests on seats made of molded plywood, the invention is based on the object of proposing a solution which reduces the previous structural and material outlay and at the same time satisfies all requirements with regard to long-term stability and expectations for use and very high design standards. The aim

is to obtain the greatest possible stacking density of piled-up chairs, in which case the chairs positioned below in each case should not suffer any damage even when subjected to a high load and hurried stacking and unstacking. Seat cushions which are possibly placed on them are not to obtain any lasting deformation from the lower side of the seat plate placed above them. Even when the seats are supplemented by armrests, high stacking density and a forwardly directed overhang which is as small as possible are still to be obtained.

A further object is to provide a row connector for combining a seat with the respectively adjacent seat, in order to be able to place a multiplicity of seats in an orderly row and to preserve the row when people are moving around it. Finally, the seats are to be able to be produced in series with an efficient outlay.

#### Summary of the invention

The seat has a seat plate which, in principle, is arranged horizontally and has at least two parts which lie one above another in layers and are joined together and, as the upper and lower parts of the seat plate, consist of molded plywood or glued together in layers and extend partially or completely over the seat plate. Furthermore, the seat has legs which protrude to the floor and have extensions at the top. Grooves are incorporated by cutting on the lower side of the upper part that faces the lower part and grooves are integrally formed without cutting on the upper side of the lower part that faces the upper part. Between the parts of the seat plate, the extensions of the legs are fitted in the grooves.

Preferred design details are described below: the upper and the lower part extend over the entire seat plate. In order to complete the seat to make a stool into a chair, there is a backrest which, in principle, is vertical. The upper and lower parts of the seat plate preferably merge integrally into the backrest. The legs emerge from the corner regions of the seat plate and are connected to one another in pairs by extensions which merge into one another. These extensions are, in principle, angled horizontally and are attached in the corner regions of the seat plate. One front leg and one rear leg in each case form an interconnected pair. The extensions of both pairs of legs extend in the form of bows to-

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ward the central region of the seat plate. The upper part is of greater material thickness than the lower part.

5 In a further version, armrests of a *first variant* are arranged on the chair and have extensions at their first and second ends. Additional grooves are incorporated by cutting on the lower side of the upper part that faces the lower part, and additional grooves are integrally formed without cutting on the upper side of the lower part that faces the upper part. Between the parts of the seat plate and the backrest, the extensions of the armrests are fitted in the additional grooves.

10 In one modification, the two armrests can be connected integrally to each other by a bow. In this design, an additional groove is incorporated by cutting in the backrest, on the side of the upper part that faces the lower part. Furthermore, an additional groove is integrally formed without cutting in the backrest, on the  
15 side of the lower part that faces the upper part, said groove lying in a complementary manner with respect to the groove in the upper part. Between the parts of the seat plate and the backrest, the bow which connects the armrests is fitted in the additional grooves.

20 In the case of a version with armrests of a *second variant*, the armrests have securing elements at their first ends, and a free-swinging armrest section extends in each case toward the second end of the armrests, said armrest sections being intended as an arm support for the users. In this design, a noncontinuous recess is incorporated by cutting on both sides in the backrest, on the  
25 side of the upper part that faces the lower part. Also, apertures which are complementary with respect to the recesses are provided on both sides in the backrest, in the lower part. Between the parts of the backrest, the securing elements of the armrests are embedded in the recesses and apertures and are supported therein. The securing element of the armrest is advantageously of plate-shaped  
30 geometry. The elongated armrest section merges in a transition in an angled manner into a shorter supporting section which opens into the backrest. The cross section of the armrest section has a greater horizontal extent than in the vertical direction. In the bent transition from the armrest section to the support-

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ing section, the profile of the armrest is rotated through 90°, as a result of which the cross section of the supporting section has a greater vertical extent than in the horizontal direction. The securing element is situated in the plane of the vertical extent of the supporting section and protrudes above and below the latter.

In the case of seats stacked one above another, the rear legs, which protrude out of the seat plate, come to lie in each case directly in front of the rear legs of the respectively lower seat. The front legs are then positioned in each case at a distance in front of those of the respectively lower seat. Space remains between the backrests in order to provide a backrest cushion without increasing the forwardly directed overhang of seats stacked one above another.

In the case of seats which are stacked one above another and are provided with armrests of the *second variant* having a free-swinging armrest section, the respective armrests on one side of the seats come to lie one above another without increasing the stack height or the forwardly directed overhang. In this case, the horizontal distance and the vertical offset between respectively adjacent backrests of seats stacked one above another provide sufficient space for the supporting sections, the transitions and the armrest sections of the armrests.

Furthermore, a row connector for combining a seat with a respectively adjacent seat is proposed. The row connector comprises a shackle-like clip part and a slide. The clip part has a central section from which grasping claws branch off symmetrically to both sides, said grasping claws having a clear width between them which corresponds to the distance between two rear legs of seats placed adjacently in a row. The grasping claws have an inner configuration which corresponds to the cross section of the rear legs in the vicinity of the height of the bending-away transition into the extensions. The clip part brought into the clamping position can be fixed releasably by means of the slide, the clamping position lying in the vicinity of the height to the bending-away transition into the extensions.

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A rail guide for the withdrawable reception of the sliding rail of the slide is provided on the clip part, on the inside of its central section. In the upper region, the central section has a latching contour. A clamping plate is attached at the top of the sliding rail and, in each case facing the grasping claws, has a curved recess for the passage of the cross section of the rear legs. An angled, directly or indirectly elastic hook which is pointed toward the central section is arranged right at the bottom of the sliding rail and, when the slide is inserted to the maximum, grasps the lower edge of the central section from below. A defined withdrawing force is required in order to release the hook again from this securing means. When the slide is withdrawn to the maximum, the hook is intended for latching into the latching contour.

A method for producing the seats according to the invention is based on the fact that there are the following components:

1. An upper part and a separate lower part having a seat plate which, in principle, is horizontal and – in the case of a seat in the form of a chair – merges into a backrest which, in principle, is vertical. The thicker upper part and the thinner lower part consist of molded plywood which is glued together in layers, for example of beech.
2. Two pairs of legs which in each case form a front leg and a rear leg, having extensions which, in principle, are angled horizontally and merge into one another and extend in the form of bows toward the central region of the seat plate.

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In the manufacturing process:

1. Grooves are made by cutting on the lower side of the upper part that faces the lower part, preferably by milling out.
2. Grooves are integrally formed without cutting on the upper side of the lower part that faces the upper part.
3. The extensions of the legs are placed into the grooves between the upper part and lower part.

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4. After that, the upper part and lower part are connected in a sheet-like manner to each other, preferably by gluing them together.

In the case of a version with armrests, in addition to the grooves incorporated by cutting and grooves integrally formed without cutting, precise receiving contours are provided in the upper and lower part for the purpose of fixing the armrests in place.

Brief description of the attached drawings

10 In the drawings:

Figure 1A shows a chair according to the invention, in perspective view;

Figure 1B shows the chair according to Figure 1A, supplemented with armrests of a *first variant*;

15 Figure 2A shows the chair according to Figure 1B, having the armrests of a *first variant*, in an exploded view;

Figure 2B shows a detail of the seat upper and lower part from Figure 2A, in enlarged form;

20 Figure 3A shows the seat upper part with a milled-out cavity for receiving the transverse strut of a foot or an armrest together with the associated, deformed seat lower part, as a basic illustration in section;

Figure 3B shows the illustration according to Figure 3A with a foot or armrest inserted;

25 Figure 3C shows the illustration according to Figure 3B with the seat upper part and seat lower part connected;

Figure 4A shows the chair according to Figure 1B with free-swinging armrests of a *second variant*, in a perspective view from the front;

30 Figure 4B shows the illustration according to Figure 4A from the rear;

Figure 5A shows a separate, free-swinging, right armrest of the *second variant*, from the illustration according to Figure 4A, in a perspective view;

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Figure 5B shows a left armrest of the *second variant*, which is complementary with respect to the right armrest according to Figure 5A, in a perspective view;

5 Figure 6A shows the detail X from Figure 4A, in an exploded illustration, as seen from the front;

Figure 6B shows the illustration according to Figure 6A, as seen from the rear;

10 Figure 7A shows the detail X from Figure 4A, with the upper and lower part separated and with the armrest of *the second variant* fitted into the lower part, as seen from the front;

Figure 7B shows the illustration according to Figure 7A, as seen from the rear;

15 Figure 7C shows the illustration according to Figure 7B, with the armrest of *the second variant* fitted into the upper part, as seen from the rear;

Figure 8A shows the detail Y from Figure 4A, with the armrest of *the second variant* fitted between the upper and lower part, as seen from the front;

20 Figure 8B shows the illustration according to Figure 8A, as seen from the rear;

Figure 9A shows the chair according to Figure 1A, supplemented with a seat and backrest cushion, in a side view;

25 Figure 9B shows the chair according to Figure 4A, with armrests of the *second variant*, in a side view;

Figure 9C shows the chair according to Figure 9B, with armrests of the *second variant*, supplemented with a seat and backrest cushion, in a side view;

30 Figure 10A shows two chairs according to Figure 9A, supplemented with a seat and backrest cushion, stacked one above the other, in a side view;

Figure 10B shows two chairs according to Figure 9B, with armrests of the *second variant*, stacked one above the other, in a side view;

Figure 10C shows two chairs according to Figure 9C, with armrests of the *second variant*, supplemented with a seat and backrest cushion, stacked one above the other, in a side view;

Figure 11A shows a disassembled row connector with the clip part and the slide, in a perspective view from the front;

Figure 11B shows the row connector according to Figure 11A, with the slide inserted to a maximum;

Figure 11C shows the row connector according to Figure 11B, in vertical section;

Figure 11D shows the illustration according to Figure 11A, with the slide withdrawn to a maximum;

Figure 11E shows the row connector according to Figure 11D, in vertical section;

Figure 11F shows the disassembled row connector according to Figure 11A, with the clip part and the slide, in a perspective view from the rear;

Figure 11G shows the illustration according to Figure 11F, with the slide withdrawn to a maximum;

Figure 12A shows the attachment of the row connector to two adjacent chairs;

Figure 12B shows the positioning of the attached row connector;

Figure 12C shows the locking of the positioned row connector;

Figure 12D shows the locked row connector in a view from the rear;

Figure 13 shows the positioning and locking of a disassembled row connector;

Figure 14A shows a rear chair leg, in a perspective view;

Figure 14B shows an attached clip part in the region A according to Figure 14A, in horizontal section; and

Figure 14C shows the positioned clip part in the region B according to Figure 14A.

### Exemplary embodiments

An exemplary embodiment of the seat according to the invention, together with a few modifications of the seat itself and with a row connector for combining  
5 with the respectively adjacent seat, will be described in detail below with reference to the attached drawings.

### Figures 1A to 2B and 9A

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The two versions which are shown of a seat – in the form of chairs without or  
10 with armrests 7,8 – comprise a seat plate 1 which, in principle, is arranged horizontally and has at least two parts 2,3 which lie one above another in layers and are joined together and, as the upper part 2 and lower part 3 of the seat plate 1, are formed from molded plywood glued together in layers and extend entirely over the seat plate 1. The chairs rest on legs 5,5';6,6' which protrude to  
15 the floor and have extensions 50,50';60,60' at the top. Grooves 20 are incorporated by cutting, preferably by milling out, on the lower side of the upper part 2 that faces the lower part 3. Grooves 30 are integrally formed without cutting on the upper side of the lower part 3 that faces the upper part 2. Between the parts 2,3 of the seat plate 1, the extensions 50,50';60,60' of the legs 5,5';6,6' are fitted in the grooves 20,30.  
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In order to complete the seat to make a stool into a chair, there is a backrest 4 which, in principle, is vertical, the upper part 2 and the lower part 3 of the seat plate 1 preferably merging integrally into the backrest 4. The legs 5,5';6,6'  
25 emerge from the corner regions of the seat plate 1. Moreover, the legs 5,5';6,6' are connected to one another in pairs by the extensions 50,50';60,60' which merge into one another, the extensions 50,50';60,60' being, in principle, angled horizontally. One front leg 5,6 and one rear leg 5',6' in each case form a pair connected to each other, and the extensions 50,50';60,60' are attached in the  
30 corner regions of the seat plate 1. The extensions 50,50';60,60' of both pairs of legs 5,5';6,6' extend in the form of bows 51,61 toward the central region of the seat plate 1. The upper part 2 is of greater material thickness than the lower

part 3, for example of double to triple strength. The upper part 2 could be 10.0 mm thick while the lower part 3 is only 4.0 mm.

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A2* In an expanded version, the chair is provided with a *first variant* of armrests 7, 8. The armrests 7,8 have extensions 70,70';80,80' at their first and second ends. Grooves 21 are incorporated by cutting on the lower side of the upper part 2 that faces the lower part 3 and grooves 31 are integrally formed without cutting on the upper side of the lower part 3 that faces the upper part 2. Between the parts 2,3 of the seat plate 1 and the backrest 4, the extensions 70,70';80,80' of the armrests 7,8 are fitted in the grooves 21,31.

The legs 5,5';6,6', together with the extensions 50,50';60,60', and the optionally provided armrests 7,8, together with their extensions 70,70';80,80', preferably consist of a metallic solid profile, for example of aluminum. At least the extensions 50,50';60,60', which lie in the grooves 20,30 between the parts 2,3 of the seat plate 1 and the backrest 4, and bows 51,61 of the legs 5,5';6,6' and the extensions 70,70';80,80' of the armrests 7,8, which extensions lie in the grooves 21,31, are of flat cross section. That is to say, these extensions 50,50';60,60' and bows 51,61 of the legs and extensions 70,70';80,80' of the armrests extend much more in cross section in the plane enclosed by the seat plate 1 and by the backrest 4 than in comparison to the cross section perpendicular with respect to said plane. The legs 5,5';6,6' and armrests 7,8 are as flat as possible in order to have to take as little as possible away from the material thickness of the upper part 2 and, at the same time, to enable outward curvatures which are as small as possible to be produced on the lower part 3, in the region of the grooves 21,31.

For softer sitting, the seat plate 1 and also the backrest 4 may be provided with a seat cushion 10 and backrest cushion 40 respectively placed on them (see Figure 9A).

Figures 4A and 4B; 9B and 9C

Here the chair is alternatively provided with free-swinging armrests **7,8** of a *second variant*. These armrests **7,8** are secured only by their supporting sections **76,86** in the backrest **4**, namely are fitted between the upper part **2** and lower part **3**, while the armrest sections **79,89** extend approximately horizontally on both sides of the chair and end freely in space.

The seat plate **1** and backrest **4** form the direct contact surfaces for the user if they are not upholstered (see Figure 9B). For softer sitting, the seat plate **1** and backrest **4** are provided with a seat cushion **10** and backrest cushion **40** respectively placed on them (see Figure 9C).

Figures 5A and 5B

A free-swinging armrest **7,8** of the *second variant* comprises the elongated armrest section **79,89** which is provided for supporting the user's arms and merges in an angled manner into the shorter supporting section **76,86** which opens into the backrest **4**. A plate-shaped securing element **77,87** is arranged at the free end of the supporting section **76,86**. The cross section of the backrest section **79,89** extends more in the horizontal direction than in the vertical direction. This produces a relatively large supporting surface for the user who is supporting his arms on the armrests **7,8**. In the bent transition **78,88** from the armrest section **79,89** to the supporting section **76,86**, the profile of the armrest **7,8** is rotated through 90°, with the result that the cross section of the supporting section **76,86** extends here more in the vertical direction than in the horizontal direction. The securing element **77,87** follows the plane of vertical extent of the supporting section **76,86** and protrudes above and below the latter.

Figures 6A to 8B

For the fastening of the armrest **8** between the upper and lower parts **2,3** of the backrest **4**, a flat recess **22** is provided in the upper part **2**, for example by milling it out, and, in said recess, the securing element **87** is embedded completely and the transition to the supporting section **86** is embedded partially. This recess **22** does not continue through the entire material thickness of the upper

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part 2 and has a web 220 which is attached to the edge of the upper part 2 and, away from the edge, merges into an eye 221 which corresponds to the plate contour of the securing element 87. In the lower part 3, at the height of the supporting section 86, there is an aperture 32, part of which is complementary with respect to the recess 22, with the result that said supporting section is partially embedded therein.

In the joined-together state, the securing element 87 is situated in the eye 221 and the supporting section 86, which extends from the securing element 87, is situated at one end in the web 220 and at the other end in the aperture 32. The securing element 87 is now covered by the lower part 3 and the lower edge and upper edge of the supporting section 86 are flanked by the edge zones of the web 220 and of the aperture 32. This increases the load-bearing capacity of the armrest 8.

As a modification, it would be conceivable to provide both ends of the armrests 7,8 with a supporting section 76,86 and a securing element 77,87 closing them off in each case. In addition, there would then be receiving contours equivalent to the recess 22 with the web 220 and the eye 221 and to the aperture 32 in the upper and lower part 2,3 of the seat plate 1, in order to embed in said receiving contours the respectively second supporting section 76,86 and the second securing element 77,87 closing it off in each case.

In a further modification of the armrests 7,8, the latter are not separate from each other, but rather – like the legs 5,5';6,6' – are connected to each other by a bow which is embedded between the upper and lower part 2,3. In a similar manner to the construction according to Figure 2B, a milled-out section is provided, for example, in the upper part 2 for this and a receiving groove formed without cutting is provided in the lower part 3.

#### Figures 3A to 3C and 6A

In the production of a seat of this type there are:

- an upper part **2** and a separate lower part **3** having a seat plate **1** which, in principle, is horizontal and – in the case of a seat in the form of a chair – merges into a backrest **4** which, in principle, is vertical, the thicker upper part **2** and the thinner lower part **3** consisting of molded plywood which is glued together in layers, for example of beech; and
- two pairs of legs **5,5';6,6'** which in each case form a front leg **5,6** and a rear leg **5',6'**, having extensions **50,50';60,60'** which, in principle, are angled horizontally, merge into one another and extend in the form of bows **51,61** toward the central region of the seat plate **1**.

- As a chair, the seat can additionally be provided with two armrests **7,8** of a *first version* which have respective extensions **70,70';80,80'** at their first and second ends. In a *second version*, the armrests **7,8** have, at one end, a securing element **77,87** to which a supporting section **76,86** is connected, said supporting section merging into a bent transition **78,88**. The armrest section **79,89**, which is intended for the arm support for the chair user, extends in a freely swinging manner away from said transition.

The manufacturing process is essentially divided into the following working stages:

- Grooves **20** are made by cutting, preferably by milling out, on the lower side of the upper part **2** that faces the lower part **3**.
- Grooves **30** are integrally formed without cutting on the upper side of the lower part **3** that faces the upper part **2**.
- The extensions **50,50';60,60'** of the legs **5,5';6,6'** are placed into the grooves **20,30** between the upper part **2** and lower part **3**.
- Finally, the upper part **2** and lower part **3** are connected in a sheet-like manner to each other, preferably by gluing them together.
- If armrests **7,8** of the *first version* are provided, further grooves **21** are made by cutting, preferably likewise by milling out, in the regions of the seat plate **1** and the backrest **4**, on the lower side of the upper part **2** that faces the lower part **3**; and further grooves **31** are integrally formed without cutting on the upper side of the lower part **3** that faces the upper part **2**.

- The extensions **50,50';60,60'** of the legs **5,5';6,6'** and the extensions **70,70';80,80'** of the armrests **7,8** are placed into the grooves **20,30;21,31** between the upper part **2** and lower part **3**.
- Finally, the upper part **2** and lower part **3** are connected in a sheet-like manner to each other, preferably by gluing them together.
- If, in contrast, armrests **7,8** of the *second version* are provided – instead of all of the further grooves **21,31** – a flat recess **22** is made by cutting, preferably by milling out, in the backrest **4**, on the side of the upper part **2** that faces the lower part **3**. This recess **22** does not continue through the entire material thickness of the upper part **2** and comprises a web **220** attached to the edge of the upper part **2**. Away from the edge, an eye **221** corresponding to the outer contour of the securing element **87** is attached to the web **220**. The recess **22** is to be dimensioned in such a manner that the securing element **87** is entirely embedded in it and the transition to the supporting portion **86** is partially embedded in it. An aperture **32** which is congruent in part to the recess **22** is incorporated in the lower part **3**, with the result that the supporting section **86** is partially placed therein.
- The extensions **50,50';60,60'** of the legs **5,5';6,6'** together with their bows **51,61** and the securing elements **77,87** and supporting sections **76,86** of the armrests **7,8** are placed into the grooves **20,30** and the recess **22** and the aperture **32** between the upper part **2** and lower part **3**.
- Finally, the upper part **2** and lower part **3** are connected in a sheet-like manner to each other, preferably by gluing them together.

#### Figure 10A

Furthermore, the overall construction of the chairs – provided here by way of example additionally with seat and backrest cushions **10,40** – also permits a small stacking height. By virtue of the fact that the extensions **50,50';60,60'** and bows **51,61** of the legs **5,5';6,6'** lie embedded in the grooves **20,30** between the upper and lower part **2,3**, i.e. are fastened internally, the stacking height of chairs stacked one above another is kept very small. The further advantages of no fastening elements for the legs **5,5';6,6'** being required below the seat plate

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legs 5',6' in the vicinity of the bending-away transition into the extensions 50',60'. On the inside, on the central section 91, there is a rail guide 93 for the withdrawable reception of the sliding rail 97 of the slide 96. A latching contour 94 is provided in the upper region, likewise on the inside of the central section 91.

A clamping plate 98 is attached at an oblique angle at the top of the sliding rail 97 and, in each case facing toward the grasping claws 92, has a curved recess 99 for the passage of the cross section of the rear legs 5',6'. An angled hook 100 which is pointed toward the central section 91 is arranged right at the bottom of the sliding rail 97. At least the hook 100, but preferably the entire row connector 9 together with the clip part 90 and slide 96, has a certain elasticity, with the result that, when the slide 96 is inserted to the maximum, the hook 100 grasps the lower edge of the central section 91 from below, and a defined withdrawing force is required in order to tear the hook 100 from this securing means. If the slide 96 is withdrawn to the maximum in the rail guide 93, the hook 100 latches into the latching contour 94 on the inside of the central section 91. If no defined force acts on the slide 96, it remains in this position, i.e. it neither automatically slips downward, nor can it fall separately out of a chair which is upside down.

#### Figures 12A to 14C

The row connector 9 is attached below the subsequent clamping region to two rear legs 5',6' of adjacent chairs, specifically with the open grasping claws 92 of the clip part 90 pointing toward the rear legs 5',6' (see Figure 12A). At a lower height, below the subsequent clamping region, the rear legs 5',6' are of smaller cross section, with the result that said cross section easily finds space within the two grasping claws 92 (see Figures 14A and 14B).

After the row connector 9 has been attached to the rear legs 5',6' it is pushed upward into the clamping position where the cross section of the rear legs 5',6' increases and now fills the interior of the grasping claws 92 (see Figures 12B, 14A and 14C).

In the clamping position which lies in the vicinity of the height of the bending-away transition into the extensions **50',60'**, the slide **96** is inserted to a maximum, with the result that the hook **100** springs below the lower edge of the central section **91** (see Figure 12C). The row connector **9** can neither be released upward, since the rear legs **5',6'** widen by means of the transition into the extensions **50',60'**, nor can it become loose downward, since it is prevented from this by the clamping plate **98** (see Fig. 12D).

10 The row connector **9** can also be used as a two-part component, with a separate clip part **90** and slide **96** released by it (see Fig. 13). The combination of the two, however, offers the advantage that the clip part **90** and slide **96** are always together and can, as it were, be more conveniently handled as one constructional unit.

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